

# EXECUTIVE SUMMARY

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## PURPOSE

A hydrofluorosilicic acid overfeed occurred at Sandy City's Paradise Valley Well facility on February 5–7, 2019. The purpose of this report is to respond to the requirement from Utah Division of Drinking Water (Division of Drinking Water Administrative Order item 17) and Salt Lake County Health Department (3/1/2019 letter) to: (1) give an explanation as to the cause of the fluoride overfeed that occurred February 5 -7, 2019; and (2) describe steps or mechanisms Sandy City Public Utilities has implemented to date and will implement in the future to ensure a fluoride overfeed will not happen again.

## CAUSE

The well had not operated since July 2016. Since the well still could have operated at any time if needed, no shutdown procedure occurred for the fluoridation system. The fluoride dosing pump was plugged in, the tubes were primed, the day tank was stocked, and the valves were set. All the physical components were in place. If the programmable logic controller allowed, the fluoride dosing pump would run.

Two main factors contributed to the overfeed:

1. **HAND setting of fluoride dosing pump.** The control for the fluoride dosing pump is normally set to AUTO, which prevents it from running without a water source. The fluoride dosing pump is powered through a special electrical outlet with interlock protection. In AUTO, the outlet is only energized when the well is running. However, during a PLC upgrade on December 19, 2018, the control was set to HAND (a mode used for testing), which bypasses this protection. Being a digital setting on the PLC screen rather than a mechanical switch, the HAND setting was not immediately visible. With the well offline and the fluoride dosing pump not running (for reasons discussed below), operators had no reason to suspect the control was set to HAND.
2. **Faulty shower/eyewash flow switch.** Second, a flow switch tied to the emergency shower and eyewash station prevents the fluoride dosing pump from running when enough water is flowing through the station. (If the eyewash or shower is flowing, it is assumed that there is a chemical problem and that the dosing should cease.) However, the flow switch was stuck in the open (flowing) position, even with no actual flow, and there was no specific visual alarm. Operators had no indication that the flow switch was faulty or that the alarm was active. Even with the control set to HAND, the flow switch and hidden alarm prevented the fluoride dosing pump from running. After January 27, 2019, the flow switch returned to the closed position. A field demonstration proved that a moderate impact, such as tapping on the switch, could spring the switch back to the closed position. On February 5, 2019, an unrelated alarm was cleared in the SCADA system and, since the only option was to “clear all” alarms, the hidden flow switch alarm was also cleared, satisfying the last remaining condition for the fluoride dosing pump to start.

The fluoridation system began injecting 23% hydrofluorosilicic acid, without any well water to dilute it, into Sandy's drinking water system at 6:40 PM on Tuesday, February 5, 2019. It ran until 1:45 PM on Thursday, February 7, 2019, when it was shut down by a Sandy City employee in response to customer complaints.

## RESPONSE

In responding to the problem, Sandy City:

1. Began investigating as soon as water quality complaints were received.
2. Sampled water in the affected area.
3. Began flushing the distribution system in the affected area to remove the contaminant (then unknown).
4. Discovered the fluoride dosing pump running and immediately unplugged it.
5. Shut the valve between the fluoride dosing pump and the distribution system.
6. Backflushed the water towards the Paradise Valley Well facility.
7. Reported the incident to the Salt Lake County Health Department (SLCoHD).
8. Conducted door-to-door notifications (after sample results indicated high levels of fluoride) and instructed residents to flush premise plumbing.
9. Used a previously prepared winter scenario hydraulic model to help determine areas where water traveled in the distribution system after the water passed by the well.
10. Reported the incident to the Utah Division of Drinking Water (DDW).
11. Issued a formal public notice with cooperation from DDW and SLCoHD.

These points summarize the City's immediate actions over the first two days. Sampling, flushing, communication, and various other actions continued for several more days and weeks.

## RECOMMENDATIONS

The following items are recommended to streamline cooperation among water utilities, regulatory agencies, and emergency response units addressing a water quality incident:

1. **Meeting documentation.** Notes should be kept during phone calls and meetings to document the issues, assignments, and expectations discussed. One person should compile the notes and distribute them by email to the other attendees.
2. **Strategic sampling.** While it is tempting to sample exhaustively during an emergency, it consumes valuable time and resources. Strategic sampling with careful thought toward locations, constituents, and frequency would produce more meaningful information to characterize the situation and inform the response. Obtain emergency sampling kits or portable meters to quickly define the severity and extent of an incident.
3. **Emergency response plans.** The City should keep their emergency response plan up to date and share them with DDW, local health department, and local fire department (who are sometimes the first responders to water quality complaints).
4. **Public notice procedure.** Clarify the procedure for public notices, including who is responsible to draft, approve, distribute, and report completion. Parties should also consider how to proactively use traditional and social media to notify the public throughout the response.

The following items are recommended at all City wells to prevent similar incidents and build response capacity:

1. **Shutdown procedure.** Establish a standard operating procedure (SOP) for shutting down the fluoridation system. At a minimum the SOP should direct operators to unplug the fluoride dosing pump, drain the feed line, shut the valve between the fluoride feed line and discharge pipeline, turn the control switch to OFF, and record these actions in a log. Utilize a lock-out/tag-out procedure for work on the fluoridation system, including PLC/SCADA modifications.
2. **Mechanical switch.** Replace the digital fluoride dosing pump control on the PLC screen with a mechanical switch (HAND/OFF/AUTO) and install a timer for the HAND setting. Remove the HAND setting from the SCADA system to avoid an accidental remote start.
3. **PLC/SCADA procedures.**
  - Audit the current PLC programming for hidden alerts and verify the logic.
  - Remove the command to “clear all” alarms and add the ability to clear only specific alarms.
  - Supervise PLC/SCADA contractors working on site. Update PLC/SCADA work procedures to document changes, functionality, and/or testing and completion logs.
  - Unplug equipment when working on the PLC with appropriate lock-out/tag-out.
  - Develop checklist and in-house capability to review PLC and SCADA programming.
  - At sites with hazardous materials, consider a PLC and/or electrical contact relay alarm and externally visible (red light) and/or audible with signage to call Sandy Emergency Dispatch.
4. **Operation and maintenance.** To avoid using the HAND setting, consider starting the fluoridation system after the well has started and the fluoride dosing pump is set to AUTO. Check the fluoride controls after a power outage or PLC/SCADA work. Fill the day tank with only enough hydrofluorosilicic acid for one day. Do not go more than two days without visiting the site; use asset management system to alert of skipped visits.
5. **Monitoring.** Install an automated pH and fluoride meter downstream of the injection site that can alert operators of an overfeed. Also have handheld pH equipment available for field sampling.
6. **Emergency Response Plan update and training.** Work with DDW and SLCoHD to update public notification forms and Public Water Supplier/Operator training for chemical overfeeds. Review, update, and provide regular training on Sandy Public Utilities Emergency Response Plan, including updated draft public notices for fluoride overfeed and other water quality contamination events (backflow, etc.) and sampling data collection reports. Update Sandy public communications tools and information (social media, reverse 911, door hangers, neighborhood notices, etc.). Update emergency sampling communications, protocols, and resources with primary and backup certified laboratories. Obtain emergency kits or meters to measure fluoride, pH, lead, and copper to be used to quickly define the severity and extent of an incident.

7. **Coordination.** Coordinate with regulatory agencies on further actions and discuss lessons learned.

The City has already implemented many of these recommendations and will complete the rest when this report is approved. The City has now completed mitigation efforts (replacing pipelines and faucets) in homes where lead and copper levels continued to exceed allowable levels. The City also continues to conduct enhanced lead and copper sampling in the affected area as well as distribution system baseline sampling to monitor drinking water quality stabilization. A Corrosion Control Study Plan has been prepared and submitted separately, and the final study plan has been included in Appendix E.